A Comparison of the Prevalence of Respiratory Illnesses among Nonsmoking Mothers and Their Children in Japan and Hong Kong[1,2]

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SUMMARY Previous epidemiologic studies have associated symptoms of chronic bronchitis and other respiratory diseases with the risk for lung cancer. To assess the possible precursor or premonitory role of these conditions for lung cancer among nonsmokers, a comparison of the prevalence rates of these conditions in 2 urban industrialized communities (Hong Kong and a Tokyo suburb) with a 300% difference in female lung cancer incidence rates was conducted. A community survey of 314 nonsmoking mothers and their children in Hong Kong, and 243 mothers and children in Japan showed that the prevalence of reported chronic cough and sputum symptoms was 10 or more times higher in Hong Kong than in Japan. The disparity in the rates of respiratory diseases/symptoms was most apparent in the comparison of children. Occupational exposure to dust or fumes and larger household sizes were found to be associated with higher levels of respiratory illnesses among the Hong Kong mothers. The much higher prevalence rates of respiratory symptoms among Hong Kong than among Japanese subjects correlated with each community's female lung cancer incidence rates of 27.1 versus 8.1/100,000, respectively. AM REV RESPIR DIS 1988; 138:290-295

Introduction

A previous study on lung cancer among Hong Kong Chinese females found that patients with lung cancer were more likely to report a previous history of chronic cough or phlegm expectoration than were age-matched control subjects (1). These results were applied to those who had ever or never smoked, and a dose-response relationship was found between increasing years of experiencing these symptoms and risk for lung cancer.

The association of a previous history of respiratory diseases such as chronic bronchitis and pneumonia with lung cancer was first reported by Doll and Hill in their 1952 study on the etiology of lung cancer (2). Subsequently, other studies (3-5) also reported this association, although most did not segregate the effects of a past history of active smoking and the occurrence of these diseases.

Because Hong Kong Chinese females tend to have notably high lung cancer incidence rates, with a 1982 world age-adjusted incidence rate of 27.1 per 100,000 (6), a comparative study of females from a low incidence area such as Japan, with a world age-adjusted incidence rate of only 8.1 per 100,000 (7) for 1975-1979 in the Kanagawa Prefecture, might shed some light on this possible etiologic association. Both societies are racially similar and share a predominantly urban, industrialized environment. Yet their cultural habits and diets are sufficiently different to raise the possibility that their respective exposures to a variety of pollutants or protectors account at least in part for the 300% difference in their lung cancer rates.

The purpose of this cross-sectional study was to compare the prevalence rates of respiratory illnesses among children and mothers residing in 2 communities, one in Japan and the other in Hong Kong. Only subjects with no previous history of active smoking were included. We wanted to know if differences found in their respective prevalence rates of respiratory illnesses would help explain the differing lung cancer incidence rates in the 2 populations. In addition, we wanted to know if these data could point to possible precursor respiratory conditions that might increase the individual's susceptibility to environmental carcinogens or that might indicate early premonitory symptoms since lung cancer is usually detected decades later.

Methods

Japanese Subjects

In July 1982, students from Grades 2 through 6 attending 2 public primary schools around the Tokyo area were surveyed. One school was located at the Suginami-ward in Tokyo and the other in Aikawa in the Kanagawa Prefecture, which is located about 50 kilometers west of Tokyo. The mothers of the surveyed children were also studied. These subjects were chosen from these districts because they would be representative of Japanese living in urban and rural environments in Japan. The Suginami-ward is a typical urban residential area with several heavily traveled roads traversing the district. The Aikawa area is characteristically rural without major factories and heavily traveled roads.

The response rate was 99.6% for the 457 children and 88.2% for their 403 mothers/guardians. Out of this sample, the following data were not included in this analysis: incompletely answered questionnaires (n = 38), guardians who were not mothers of the children (n = 11), any who reported a previous history of active smoking (n = 68), and, in situations where 2 or more children from the same family were surveyed and attended the same school (n = 95), only 1 of the children was randomly selected. Thus, the results from 243 mother-child pairs were analyzed for this study.

Hong Kong Subjects

A government-subsidized primary school in the Ngau Tau Kok area of the Kwun Tong

(Received in original form April 7, 1987 and in revised form February 5, 1988)

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[2] Supported by Monbusho International Scientific Research Program and the Hong Kong Anti-Cancer Society.

TABLE 1

AGE DISTRIBUTION AMONG MOTHERS

Age (yr)	Hong Kong (n)	Hong Kong (%)	Japan (n)	Japan (%)
≤ 30	18	5.7	13	5.4
31–35	99	31.5	79	33.1
36–40	123	39.2	87	36.4
41–45	39	12.4	49	20.5
46–50	27	8.6	10	4.2
≥ 51	8	2.5	1	0.4
Unknown			4	
Total	314		243	
Mean age*	37.8		39.3	

* t test, p value = 0.412

TABLE 2

AGE DISTRIBUTION AMONG CHILDREN

Age (yr)	Hong Kong (n)	Hong Kong (%)	Japan (n)	Japan (%)
6	0		11	4.5
7	10	3.2	44	18.1
8	46	14.6	20	8.2
9	54	17.2	45	18.5
10	80	25.5	29	11.9
11	48	15.3	82	33.7
12	67	21.3	12	4.9
13	9	2.9	–	
Total	314		243	
Mean age*	10.1		9.4	
Girls, %†		48		46

* t test, p value = 0.0001
† t test, p value = 0.588

district of Hong Kong was selected in cooperation with the local government's Department of Education to represent subjects from a working class neighborhood. The site is surrounded by public housing in high-rise buildings and by small stores, and is within a few blocks of the small- and medium-sized factories that are common in this district.

Initially, 2 classes from each grade of 2 to 6 were planned for the study since each class averaged 36 students, and these numbers would approximate the age and sex distribution of the Japanese subjects. However, after data collection began, it was realized that some students in different classes were siblings, so an additional class in Grade 4 was included in the study. Thus, a total of 11 classes, i.e., 390 children and mothers were contacted for the study. The response rate for the return of the questionnaire was 100% for the children and 97% for their mothers/guardian (11 did not return the questionnaire). Using the same inclusion criteria as those for the Japanese subjects, 314 mother-child pairs were included in this analysis. To simulate the summer weather conditions of the Japanese collection time, the survey was conducted from May 20 to 30, 1985. The mean temperature and humidity in Hong Kong during the data collection period was 27° C and 81% humidity. The same data for Tokyo during July 1982 was 22° C and 77%, respectively. The Hong Kong data were collected in late May instead of July because the students would be off for summer vacations and thus not accessible.

Data Collection Forms

A modified version of the questionnaires originally developed by the American Thoracic Society Division of Lung Disease (ATS-DLD) (8) and the British Medical Research Council (BMRC) (9) to survey the prevalence of respiratory diseases was used. Questions were asked on the occurrence of the following: chronic cough or phlegm of ≥ 3 months duration (to eliminate those associated with acute upper respiratory tract infections), bronchitis, pneumonia, asthma, tuberculosis, allergic rhinitis, and other chest diseases.

The version for the children also included questions on sources and amounts of passive smoking exposure, and whether the child participated in home cooking activities. These questionnaires were distributed to the children at school and taken home with instructions that it be answered for the child by the mother or female guardian.

The version for the mothers included more detailed questions on cooking activities, active smoking history, and exposure to dust or fumes in the workplace. These questionnaires were distributed to the children at school with instructions that they should take them home for their mothers to fill out.

Data Analysis

The data collected in the questionnaires were coded and then processed by computer using the SPSS-X statistical package. Because the questionnaire asked about respiratory symptoms (i.e., cough, sputum, wheezing) and respiratory diseases (i.e., pneumonia, allergic rhinitis, bronchitis, asthma, tuberculosis), both were covered under the term "respiratory illnesses." These terms are distinguished in this study because "respiratory symptoms" is a lay term that is easier for the subjects to identify with, whereas "respiratory diseases" would mean that a physician had diagnosed such a condition.

Analysis of the data included descriptive, comparative, and analytical work. In comparing the results between subjects from Hong Kong versus those from Japan, *t* tests or chi-square tests were usually done to estimate the statistical significance of the findings. Analysis on the relationship of multiple illnesses per person and various exposure categories utilized Pearson's goodness of fit test. A test for linear trend in the proportions was done when dose-response relationships were suggested (10). To statistically assess the risk among the exposed group versus the unexposed group, the following were calculated: relative risks as the ratio of these 2 proportions; attributable risk as the percentage of the overall risk in the exposed group, and the population-attributable risk as the difference in risk among the whole population (which we assume the entire sample represented) and the risk in the unexposed group (10).

Results

The age distribution of the 314 Hong Kong Chinese mothers and 243 Japanese mothers is shown in table 1. The Hong Kong Chinese mothers tended to be slightly younger, with a mean age of 37.8 versus 39.3 yr among the Japanese mothers, but these differences were not statistically different (*t* test, p value = 0.41). On the other hand, the 314 Hong Kong school children were slightly older than their Japanese counterparts (table 2), with the mean age of the former being 10.1 yr and that for the latter being 9.4 yr, which was statistically significant (*t* test, p value = 0.0001). The sex ratio for the children was not significantly

TABLE 3

PREVALENCE OF SELF-REPORTED RESPIRATORY ILLNESSES AMONG NON-SMOKING MOTHERS

Respiratory Symptom/Disease	Prevalence (%) Hong Kong (n = 314)	Prevalence (%) Japan (n = 243)	Chi-Square p value
Chronic cough ≥ 3 months, %	5.7	0.4	0.0061
Chronic phlegm ≥ 3 months, %	8.0	0.4	0.0000
Cough and phlegm ≥ 3 months, %	3.2	0.4	0.0197
Cough or phlegm ≥ 3 months, %	10.5	0.4	0.0026
Bronchitis, %	7.6	5.8	0.3823
Ever had pneumonia, %	1.0	2.9	0.0897
Ever had asthma, %	1.3	2.9	0.1765
Ever had tuberculosis, %	1.6	2.1	0.6817
Ever had allergic rhinitis, %	11.5	12.4	0.7498
Ever had other chest diseases, %	0.3	1.2	0.2047
≥ 1 of the above chest illnesses, %	24.8	20.9	0.2054
Chest illnesses per sick mother, mean n	1.49	1.29	0.1371

* p value by t test

TABLE 4

PREVALENCE OF RESPIRATORY ILLNESSES AMONG CHILDREN AS REPORTED BY THEIR MOTHERS

Respiratory Symptom/Disease	Prevalence (%) Hong Kong (n = 314)	Japan (n = 243)	Chi-Square p Value
Cough ≥ 3 months, %	7.0	0.4	0.0001
Phlegm ≥ 3 months, %	9.2	0.4	0.0000
Cough and phlegm, %	3.5	0	–
Cough or phlegm, %	12.8	0.8	0.0000
Cough or phlegm, yr/person	4.7	3.5	0.742*
Wheezing ≥ 3 months, %	7.6	1.7	0.0013
Wheezing, yr/person	4.8	6.8	0.180*
Ever had allergic rhinitis, %	9.2	11.1	0.4654
Ever had pneumonia, %	8.0	0	–
Ever had asthma, %	8.3	10.7	0.3304
≥ 1 of the above chest illnesses, %	25.2	18.7	0.066
Chest illnesses per sick child, mean n	1.96	1.31	0.0001*

* p value by t test

TABLE 5

RELATIONSHIP BETWEEN THE FREQUENCY OF RESPIRATORY ILLNESSES BETWEEN MOTHER/CHILD IN HONG KONG AND IN JAPAN*

Illnesses per Child (n)	Illnesses per Mother (n) 0	1+	Total
Hong Kong			
0	186	48	234
1+	49	30	79
Total	235	78	313
Relative risk = 1.85†			
Japan			
0	157	33	190
1+	28	15	43
Total	185	48	233
Relative risk = 2.00‡			

* The presence of the following respiratory illnesses unrelated to cold/flu: cough ≥ 3 months, phlegm ≥ 3 months, wheezing, pneumonia, asthma, allergic rhinitis, bronchitis, TB, and other chest diseases.

† Pearson's correlation coefficient 0.18, p value = 0.009.

‡ Pearson's correlation coefficient 0.17, p value = 0.005.

different for the 2 groups, with 48% of the Hong Kong children and 46% of the Japanese children being girls (t test, p value = 0.59).

The prevalence rates among mothers reporting a previous history of respiratory illnesses is shown in table 3. Among Chinese mothers, 5.7% (n = 18) reported a previous history of chronic cough, and 8.0% (n = 25), a history of chronic phlegm expectoration lasting 3 or more months. This contrasted with only 1 Japanese mother (0.4%) who reported having both such symptoms. For the other respiratory diseases, the prevalence rates between the 2 groups did not reach statistical significance ($p \leq 0.05$). In general, there was a tendency for more Hong Kong mothers to report a previous history of chest problems (24.8 versus 20.9%); among those who had such diseases, Hong Kong mothers had more illnesses per person (1.49 versus 1.29) than did Japanese mothers. There was no relationship between the prevalence rates of respiratory illnesses and age of the mother in either population (chi-square, p value = 0.236 for Hong Kong mothers and 0.274 for Japanese mothers).

The prevalence of respiratory illnesses among children was similar to that of their mothers (table 4). One (0.4%) Japanese child was reported by the mother to be suffering from chronic cough, and another (0.4%) was reported to have chronic phlegm, whereas among the Hong Kong children these percentages were 7.0% (n = 22) and 9.2% (n = 29), respectively. When the 2 symptoms were combined, 12.8% (n = 40) of the Hong Kong children had one or both symptoms, whereas this was true for only 0.8% (n = 2) of the Japanese children. All of these differences were statistically significant.

Among the other respiratory illnesses for the children, those in Hong Kong had statistically higher frequencies of wheezing (7.6 versus 1.7%) and pneumonia (8.0 versus 0%) than did their Japanese counterparts. The reported rates for allergic rhinitis and asthma were not statistically different for the 2 groups.

In the summary measurements, 25.2% of the Hong Kong children had one or more of the surveyed respiratory illnesses versus 18.7% among the Japanese children (p = 0.066). Moreover, among those with such illnesses, the former group had a significantly larger mean number of problems per child (1.96) than did the latter (1.31).

The distribution of multiple illnesses within a single individual in the 2 areas is shown in table 5. Hong Kong mothers and children consistently had higher percentages of such individuals than did the Japanese. This discrepancy was most apparent among the children, with 24 Hong Kong children (7.7%) having 3 or more respiratory illnesses versus only 1 Japanese child (0.4%) with such a history, and a comparison of their mean number of illnesses per child was highly significant (p = 0.0001).

The frequency of illnesses in the mothers was related to that reported for their children as shown in table 6. In both populations, mothers who reported one or more respiratory illnesses for themselves were about twice as likely to report such illnesses in their children. Pearson's goodness of fit test showed this relationship to be highly significant.

TABLE 5

FREQUENCY OF MULTIPLE RESPIRATORY ILLNESSES AMONG MOTHERS AND CHILDREN IN HONG KONG AND JAPAN

Illnesses per Mother* (n)	Hong Kong Mothers (n)	(%)	Japanese Mothers (n)	(%)	Illnesses per Child† (n)	Hong Kong Children (n)	(%)	Japanese Children (n)	(%)
0	235	75.1	185	79.4	0	234	74.8	190	81.5
1	54	17.3	39	16.7	1	45	14.4	30	12.9
2	14	4.5	4	1.7	2	10	3.2	12	5.2
3	7	2.2	5	2.1	3	11	3.5	1	0.4
4+	3	0.9	–	–	4+	13	4.2	–	–
Total	313	100	233	99.9‡		313	100.1‡	233	100
Mean	0.37		0.27			0.69		0.24	

* The presence of the following respiratory illnesses unrelated to cold/flu: cough ≥ 3 months, phlegm ≥ 3 months, pneumonia, allergic rhinitis, bronchitis, asthma, TB, and other chest diseases.

† The presence of the following respiratory illnesses unrelated to cold/flu: cough ≥ 3 months, phlegm ≥ 3 months, wheezing, pneumonia, asthma, allergic rhinitis.

‡ Due to rounding off, the total sum was not 100%.

TABLE 7

RELATIONSHIP OF OCCUPATIONAL DUST OR GAS/FUME EXPOSURE WITH RESPIRATORY ILLNESSES AMONG HONG KONG MOTHERS*

Exposure at Work	Total Number of Mothers	Mothers with ≥ 1 Respiratory Illnesses† (n)	(%)	Relative Risk
Dust				
No exposure	246	55	22.4	1.00
Mild	39	12	30.8	1.38
Moderate	25	9	36.0	1.61
Severe	4	2	50.0	2.23
Total exposed	68	23	33.8	1.51
Gas				
No exposure	278	63	22.7	1.00
Mild	23	9	39.1	1.72
Moderate	11	5	45.5	2.00
Severe	2	1	50.0	2.20
Total exposed	36	15	41.7	1.84

* Linear trend p value ≤ 0.05. Pearson's correlation coefficient significance p value presence and absence of illnesses: dust = 0.017, gas = 0.007. Exact number of illnesses: dust = 0.007, gas = 0.0008.

† The presence of the following respiratory illnesses unrelated to cold/flu: cough ≥ 3 months, phlegm ≥ 3 months, pneumonia, allergic rhinitis, bronchitis, asthma, TB, and other chest diseases.

TABLE 8

COMPARATIVE PROFILES OF HONG KONG AND JAPANESE MOTHERS AND CHILDREN

Lifestyle Variable	Hong Kong (n)	Hong Kong (mean)	Japan (n)	Japan (mean)	Chi-Square p Value
Mother currently works outside the home	106	33.9%	68	28.0%	0.138
Father currently smokes	110	35.6%	146	60.1%	0.0000
Home has ventilated cooking*	251	79.9%	192	79.2%	0.789
Mean household size	314	5.31	243	4.54	0.0000†

* Cooking area has electric ventilating fan or cooking hood.

† p value by t test.

To understand the role of occupational exposures, the Hong Kong mothers were asked in the questionnaire whether they had ever worked for a year or more in places where they were exposed to noticeable levels of dust/smoke or gases/fumes, the degree of such exposure, where such exposure occurred, and what they did. Analyses of all the variables showed that the frequency of respiratory illnesses among Hong Kong mothers was highly related to their reports of previous exposure to dust or gas fumes (table 7) in the workplace.

Overall, some 21.7% (n = 68) of the total sample of Hong Kong mothers reported a previous history of occupational exposure to dust, and 11.5% (n = 36) to gas/fumes. The percentages of exposed mothers with one or more respiratory illnesses increased proportionately with the degree of reported severity of exposure to such air pollutants in a dose-response manner. Among those exposed to severe levels of either pollutant, the attributable risk was calculated to be 55%. Gas fumes seemed to exert a larger effect than did dust, as the attributable risk was 45.6% for the former versus 33.8% for the latter.

Although the same questions were not asked in the Japanese survey, data on Japanese mothers currently employed in dusty industries such as mining showed no relationship with their prevalence of respiratory illnesses. In addition, when comparing the lifestyle profiles of the 2 populations (table 8), it can be seen that mothers in Japan were less likely to work outside the home, so that their likelihood of being exposed to such occupational exposures would be less than that of the Hong Kong mothers.

In terms of possible sources of indoor air pollutants in the home, the data did not help explain the discrepancy in prevalence rates in the 2 populations. Some 60% of the Japanese fathers were current smokers versus only 36% of the Hong Kong fathers. Although cooking styles are greatly different between the 2 populations, with Chinese cooking methods more likely to produce cooking fumes because of the stir-fry method, the percentages of kitchens with mechanical ventilation fans/hoods was the same in both populations, i.e., 79 to 80%.

It was interesting to note that the mean household size was statistically different (p = 0.000), with Hong Kong families averaging 5.31 persons versus 4.54 persons in Japan. The effects of family size on the frequency of respiratory illnesses are shown in table 9. There was a tendency for Hong Kong mothers living in larger households to report more respiratory illness than those living in smaller ones. However, such was not the case for the Japanese mothers. Moreover, among the Hong Kong mothers, no relationship was found between household density, i.e., the total number of people in the family

TABLE 9

RELATIONSHIP OF FAMILY SIZE TO RESPIRATORY ILLNESSES AMONG HONG KONG AND JAPANESE MOTHERS*

Household Size	Total Number of Mothers	Mothers with ≥ 1 Respiratory Illnesses† (n)	(%)	Relative Risk
Hong Kong				
Small, ≤ 4	100	22	22.0	1.00
Medium, 5 to 6	155	37	23.9	1.09
Large, 7+	59	19	32.2	1.46
Total	314	78	24.8	
Japan				
Small, ≤ 3	28	5	17.9	1.00
Medium, 4 to 5	175	40	22.9	1.28
Large, 6+	40	9	22.5	1.26
Total	243	54	22.2	

* Pearson's correlation coefficient significance and p values. Presence and absence of illnesses: Hong Kong r = 0.024, p = 0.33; in Japan r = 0.025, p = 0.35. Exact number of illnesses: Hong Kong r = 0.076, p = 0.09; in Japan r = 0.034, p = 0.30.

† The presence of the following respiratory illnesses unrelated to cold/flu: cough ≥ 3 months, phlegm ≥ 3 months, pneumonia, allergic rhinitis, bronchitis, asthma, TB, and other chest diseases.

TABLE 10

RELATIONSHIP OF HOUSEHOLD DENSITY WITH RESPIRATORY ILLNESSES AMONG HONG KONG MOTHERS*

People per Room (n)	Total Number of Mothers	Mothers with ≥ 1 Respiratory Illnesses†		
		(n)	(%)	Relative Risk
Low, ≤ 2.49	81	20	24.7	1.00
Medium, 2.5 to 3.5	105	23	21.9	0.89
High, > 3.5	128	35	27.4	1.11
Total	314	78	24.8	

* Pearson's correlation coefficient and p values: presence and absence of illnesses $r = 0.031$, $p = 0.29$; exact number of illnesses $r = 0.008$, $p = 0.44$.

† The presence of the following respiratory illnesses unrelated to cold/flu: cough ≥ 3 months, phlegm ≥ 3 months, pneumonia, allergic rhinitis, bronchitis, asthma, TB, and other chest diseases.

divided by the number of rooms they occupied, and the frequency of respiratory illnesses (table 10). The Japanese data did not contain information on household density for comparative analysis.

Discussion

The findings of this preliminary epidemiologic study on the prevalence of respiratory illnesses among never-smoked mothers and children in Hong Kong and Tokyo suggest that such illnesses are much more common in Hong Kong. Hong Kong subjects were 10 or more times more likely than their Japanese counterparts to report symptoms of chronic cough and phlegm expectoration exceeding 3 months duration.

The differences in reported frequencies of respiratory illnesses were greatest in the comparison of school children. Hong Kong children were 4.5 times more likely to have had a previous history of wheezing, and 8 times more likely to have had pneumonia than were Japanese children. Overall, 25.2% of the Hong Kong children versus 18.7% of the Japanese children had one or more of the surveyed chest illnesses, and their mean numbers of chest illnesses per sick child were 1.96 and 1.31, respectively. All of these differences were statistically significant, with the comparison of those with chest illnesses of borderline significance ($p = 0.066$).

We feel that the interpretation of these findings must be viewed in light of the degree of medical knowledge of the 2 populations. For a mother to report that she or her child had suffered from such diseases as bronchitis, pneumonia, asthma, tuberculosis, or allergic rhinitis, she would have had to have been told by a doctor of such a diagnosis/description of the problem. Because doctor-patient communication is poor in Hong Kong, and patients are frequently not told the diagnosis nor the names of the drugs that are prescribed, the knowledge/usage of such medical terms among the population would be infrequent. This would be especially true among the working-class mothers whose average educational attainment is primary school only (11). Thus, these illnesses, which we have labeled as "respiratory diseases," would tend to be underreported in the Hong Kong population. On the other hand, such common descriptive terms as cough, phlegm expectoration, and wheezing are well understood by all, and thus the survey was able to reflect a more accurate recording of the prevalence of these symptoms.

Evidence for the fact that the greater unfamiliarity with medical terms among the Hong Kong mothers seemed to influence their reported frequencies is reflected in the unrealistically low reporting rate of tuberculosis. Only 1.6% of the Hong Kong versus 2.1% of the Japanese mothers reported having such a history. Yet it is known that the real rate should be much higher in Hong Kong since tuberculosis is still a common infectious disease in that community, with 137.4 new cases/100,000 population reported and a mortality rate of 8.4/100,000 (12) registered in 1983. The comparable incidence and mortality rates for Japan in 1985 were 48.4/100,000 and 3.9/100,000.

The Hong Kong subjects also reported more respiratory illnesses per person than did the Japanese subjects. These differences were especially notable among the children where the group mean values showed the Hong Kong children to be more than 2.9 times higher than those of the Japanese children (t test, p value = 0.001). No differences were observed in the frequencies of these illnesses by sex of the child.

Although the Hong Kong children were on average 8.5 months older than the Japanese children, we did not feel that this slight age difference could account for the large differences observed in the Hong Kong children's higher reported frequencies of respiratory illnesses. In addition, the children in both populations have been immunized with the generally recommended schedule of diphtheria, pertussis, polio, BCG, etc. vaccines, so these differences were not due to immunization rates.

For both populations, however, there was a highly significant correlation between the frequency of respiratory illnesses of each mother and her child. Mothers who reported one or more illnesses for themselves were about twice as likely to report a similar number for their children.

For the Hong Kong mothers, a significant relationship was detected with increasing exposure to dust/smoke or gas/fumes in the workplace. The occurrence of respiratory illnesses seemed to be related to occupational exposures to such pollutants in 34% of those ever exposed to dust/smoke, and 46% of those ever exposed to gas/fumes. For the Hong Kong population as a whole, the attributable risk percentage was 10.0% for the former and 8.8% for the latter. However, analysis of the data by whether the mother was currently employed or not did not show any significant differences in the reported frequencies of respiratory illnesses for herself or her child.

The consistent tendency for Hong Kong subjects to have higher prevalence rates of respiratory illnesses than their Japanese counterparts is difficult to explain. Although, as shown above, some relationship was found with previous occupational exposure to dust or fumes in the workplace, the percentages of mothers currently working was not statistically different in the 2 groups.

The role of indoor air pollution in the home from passive smoking or heating/cooking activities has been investigated. Japanese fathers were about twice as likely to be smokers than were Hong Kong fathers. Moreover, in another report on the Hong Kong mothers (13), no association was found between the prevalence of chronic cough or sputum and the smoking patterns of their husbands. The etiologic role of cooking activities is also doubtful, as the proportion of kitchens with mechanical ventilation such as fans or cooking hoods was not different in Toyko and Hong Kong. Previous case-control studies on the role of cooking fuels in lung cancer risk among females in Hong Kong (14) and Japan (15) did not find an association between fuel type (i.e., kerosene, liquid petroleum gas, charcoal, and wood grass) and lung cancer risk.

Among the variables compared, Hong Kong families tended to be significantly larger, averaging 5.31 persons versus 4.54 for Japanese households. Among Hong Kong mothers, some association was found between larger household size and the frequency of respiratory illnesses, but such was not the case for household density. Moreover, larger household size was not associated with more respiratory illnesses among the Japanese mothers. Although both household size and density are related with socioeconomic status, the lack of an association with household density in Hong Kong would seem to indicate that these variables were not simply surrogate measures of household income. This is because, with the extremely expensive rental situation in Hong Kong, higher density living is directly associated with less income, whereas household size may reflect the persistence of an extended family system and, traditionally, according to the Confucian ethos, 3-generation families are desirable.

Several possibilities may help explain the patterns of respiratory illnesses in both populations. Recall bias may play a role as there was an increasing tendency for mothers reporting one or more respiratory illnesses for themselves to report the same for their children. This tendency was found in both the Japanese and the Hong Kong mothers, so it would not explain their highly different prevalence rates of respiratory illnesses. The principle of recall bias may have operated also on the finding that occupational exposures were related to respiratory illnesses among the Hong Kong mothers, since those with such illnesses may have been more likely to recall such past exposures than those without such problems. However, occupational exposures to such pollutants could only account for 9 to 10% of the respiratory illnesses in the Hong Kong mothers.

The role of cross infection, i.e., mother to child or other household members to mother or child, seems suggested by: (*1*) the direct association between household size and frequency of respiratory illnesses in the Hong Kong mothers, (*2*) the correlation between multiple respiratory illnesses within each mother-child pair in both populations, and (*3*) that Hong Kong families were significantly larger than Japanese families. However, no such association was found with household density, which would seem a more direct measurement of the potential for cross infection since the chances of spreading infectious respiratory diseases should be correlated with higher household densities. It appears that other not yet identified environmental factors are needed to explain these results.

The findings of this study, showing mothers and especially children in Hong Kong to have larger numbers of sick subjects and to have more illnesses per subject than their Japanese counterparts, are consistent with the findings of other surveys in both areas. Questions added to an international survey in 1986 on passive smoking and urinary cotinine levels sponsored by the International Agency for Research on Cancer indicated that women in Hong Kong were about 10 times more likely to report symptoms of chronic cough or phlegm than were women in Sendai, Japan. A population survey of respiratory illnesses in Japan in 1983 (T. Mori, personal communication) indicated that the reported age-adjusted rates of such illness for nonsmoking women in Japan were similar to those reported among the Japanese mothers in this survey. Thus, we feel that the reported differences in the frequencies of respiratory illnesses in Hong Kong and Japan are not artifactual.

These results agree with the contrasting female lung cancer incidence rates in the 2 areas. The epidemiologic data showed that chronic bronchitis was associated with increased risk for lung cancer in females (1). Moreover, the multistage model of carcinogenesis makes this association biologically plausible since these symptoms result from and result in a chronic irritation effect on the respiratory tract, making it more susceptible to the action of carcinogenic initiators or promoters. Previous occupational exposure to dust or fumes was associated with respiratory illnesses in the Hong Kong mother, and frequencies of such illnesses in the mother were directly related to those in her child. Although this could account for a portion of the respiratory illnesses, more investigation is needed to find other etiologic agents in the Hong Kong environment to account for the higher frequency of respiratory health problems. A recent time-trend analysis by Barker and Osmond (16) in England and Wales showing that respiratory diseases in childhood led to higher mortality rates from chronic bronchitis and emphysema later in adult life, ominously suggests that the high rates of childhood respiratory illnesses found in the Hong Kong population today portends to excess mortality from respiratory diseases in the future when these children reach 40+ yr of age.

Acknowledgment

The writers thank the Director of Education of Hong Kong for his advice and permission to carry out this study; the headmaster and teachers of the S. K. H. Kei Hin Primary School in Hong Kong for their kind assistance in the field work; Mr. H. C. Kwan of the Radiotherapy Department of the Queen Elizabeth Hospital for data collection; the Air Policy Group of the Environmental Protection Department of the Hong Kong government for data on air pollution; Dr. P. Witorsch for his comments on chest symptoms; Ms. C. Y. Ho for data management; Mr. K. Li for statistical work; and Mrs. T. Lam, Ms. A. Chow, and Ms. M. Chi for secretarial assistance.

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